Reclosable Beverage Can (Can, Cap & Cup)

The invention concerns a closable can body and a filled can, adapted to be used and closed again after an only partial consumption of a content of the can (having a body and a lid).

Background of invention.

A beverage metal can (as two part system, having an integrated base can body and can lid) is one of the most accepted packages for single servings around the world. Consumers enjoy this package because of its convenience in handling, its quality performance in protecting its content and its attractiveness supported by a number of useful features.

Beverage cans are popular for drinks consumption at home, in-door and out-door. Out of home consumption represents a remarkable percentage, i.e. during travelling, sports and other events. In the latter, the content of the can is often not consumed at once but with interruptions, so complete emptying of the can may extend into the range of an hour or longer. Here the can lacks a reclosability feature, despite the fact that the beverage can was initially designed for single servings (use) only.

Reclosability is considered a useful feature not only to preserve product freshness after partial product take-out but also to prevent product contamination and insect penetration during the period from initial opening to final emptying of the can. The latter may also imply a non-neglectable health and hygiene risk during outdoor consumption.

Prior art is known, opening the can on the lid side, and closing it with a cap from the same axial side, cf. **WO-A 97/36739** (Schmalbach-Lubeca, Lutz Strube) or **WO-A 01/66431** (Goetz, Ackermann, Folland). The bottom (base) of a can already was suggested to be penetrated for closing, when using an inward domed bottom, cf. **WO-A 03/066455** (Schmalbach-Lubeca, Ball Europe, Bert Bast et al.). A bottom up can with a re-closing cap on a spout is shown in **DE-A 198 02 953** (Rasselstein Hoesch), but having a substantial circumferential step in the outward bulging bottom (upside) with axial height enlarging under can pressure and no real standing/support facility for allowing a can like filling; said beverage can uses a bottle type filling through the spout.

Summary of the Invention.
Object of the invention.

Object of the invention is to comply with a consumer's desire and remove the shortfall of the two part can system not being reclosable by providing a facility of re-closing.

The invention is to improve the can's suitability for outdoor application and time extended consumption by allowing the consumer to effectively reclose a "take out opening" of the can every time after partial drink take-out occurred.

The invention suggests cooperating components under one of claim 1 to 4 for a beverage can or claims 27 to 30 for a stackable body of a can. The components are

1. A can body for holding liquid, such as beverages.
2. Optional, a can lid.
3. A spout for pouring or drinking - associated with the bottom.
4. A cap for screw able re-closing.
5. Optional, an add-on containment-vessel.

The invention provides the feature of a re-closing closure near the base of the can or can body, contrary to a reclosable can lid. The non-openable end portion of the can receives a standard design, with or without having a necked-in portion of the wall, and a body hook flange formed at the most upper part of the can body.

A commonly concave shaped dome as (inwardly) shaped base of the can is replaced by a convex design, vaulting to the outside (in axial direction). The outward domed, vaulted shape is a soft shape having no intermediate steps near the wall or near the spout. The curvature of the vaulted bottom does not change in direction, whereas it may change in absolute values from smaller values to larger values from radially outside to the inside near the opening. This "three radius geometry" explains the vaulted bottom.

The circular opening, centred at the shaped base provides an aperture for permanently mounting a carrier for the reclosing closure. After attaching, the reclosing closure through its peripheral contour, having an outwardly protruding level rim portion, will enable the package to stationary rest on any level (flat) support, i.e. on conveyors, on machine pusher pads and on the shelf for display, and on other can's top, etc.

The invention provides that the beverage can is handled on its closure device positioned at the can base. The closure may be provided as pre-assembled by the can manufacturer before the can body is supplied to the filling location. The filler handles the can in the common way, not requiring alterations at the filling and seaming process. After filling of the can body through a fully open second axial end, the same is covered with a can lid which is seamed to the can body for sealing and closing the container including the beverage in it. The can lid ("end") used for closing at the fillers location is without any opening tab or other mechanism, thus no commonly used "easy open end", but a non-openable end (and thus a non-closable lid).

The re-closable (openable, closable) closure device comprises a pouring or drinking spout and a reclosing screwable cap. The cylindrical spout is mounted in the opening provided about the centre of the convex shaped can base.

The preferably twistable cap having a thread, adapted to the thread of the spout and therewith allows opening and closing of the can, initial closing and (further) re-closing.

The screw cap may have a plastic inlay gasket supporting a gas and liquid tight reclosure of the package, through contacting the spout.

A built-in vent feature inside the closure initiates release of internal pressure from the can's headspace during an initial phase of opening, before the liquid content may be discharged from the can by drinking or pouring. An eventual risk of liquid splashing during can opening is at least reduced.

The re-closable closure may comprise a tamper evidence feature near its bottom end, allowing the consumer to recognize originality or any prior opening of the beverage can.

Different types of pouring or drinking spouts are suggested. One is rigid and protrudes outwardly from the can base (claim 8). The other one is of telescopic design (claim 25); it protrudes inwardly from the can base, when in a closed position and outwardly, when open, or at least prepared to be opened.

The entire reclosable can may also have a detachable containment vessel axially attached to the reclosable closure (claim 26). This is on the bottom standing end of the can.

The vessel may hold objects for the consumer, e.g. chips, nuts, crackers or other snacks or promotional gifts, coupons or messages, etc. The vessel may also be used as a drinking cup, if one would not like to drink from the can directly.

Reclosing will lead to prolonged freshness of the can's content by maintaining e.g. a maximum of the residual carbonation throughout the periods when the can is re-closed. Re-closure also enhances to hygiene and safety of the package to the benefit of the consumer, preventing penetration of contaminants, mainly insects into the beverage content.

The beverage can remains stackable (claims 14, 14a, 27). The cup or the cap nests into the lid end of another can, which rests below the "can under consideration" ("cuc"). This "cuc" still has the ability of "can type filling" instead of a "bottle type filling". The can filling is through the large opening end without a covering lid, having a secure and stable stand on the cap or the cup. This cap covers the spout and covers a large standing surface radially within an at least partially or intermittently circumferential rim (claims 13, 14). This rim on the other hand enables stacking of the "cuc" radially outside or radially within the seam of a seamed and closed can body arranged below the "cuc" in the stack (claim 27a). The rim thus is adapted in geometry to the seam of the same can although for stacking being in nesting arrangement with another can of same shape.

Said rim belongs to the re-closing cap device (re-closing closure), cf. claim 8 or 7 or 14a. The rim's shape and dimension is chosen to the dimension of the lid geometry.

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Summary of the embodiments.

The invention comprises several embodiments to enhance the invention's understanding, having four groups of figures.

Figures 1 is a first embodiment in three sets of figures (Fig. 1a, 1b, 1c).

Figures 2 is a second embodiment in three sets of figures (Fig. 2a, 2b, 2c).

Figures 3 is a third embodiment in three sets of figures (Fig. 3a, 3b, 3c).

Figures 4 is a fourth embodiment in three sets of figures (Fig. 4a, 4b, 4c).

Each Figure having an a, b and c set (e.g. Figures 1a, 1b and 1c), representing a side view (a) with seamed (right) flange and non seamed (left) flange, an enlargement of a portion near the base (b), and an exploded view showing the components (c).

Detailed description of the embodiments of the invention.

The drinks can 1 of **all Figures 1 to 4** (each "a" to "c") is as an example made in a DWI process from a cup of metal sheet. It has a convex base profile 1.1 extending lateral from a can centre axis 100. The base profile protrudes outwardly from the can inside 1i. The cross sectional profile of the outwardly domed convex can base may be of one, two or three radii design. Its convexity depth may range within a diameter/depth ratio of between 2 and 33, preferably around 7. Its profile geometry may be varied in a large range. It has no steps along he domed shape.

The exact profile design is driven by functional and by aesthetic aspects.

The can base 1.1 has a circular opening 1e at its centre, matching the centre axis of the can. The diameter of the opening is between 20mm to 40mm, preferably around 26mm (±10%). The aperture edge left by the opening 1e is to receive a spout device 3, allowing pouring/drinking. It is a part of the reclosable closure as is subject to the further parts, at least re-closing closure as a cap device 4.

The drinks can 1 is made from a sheet of steel or aluminium or plastics or cardboard or a combination thereof. A preferred example is the metal sheet.

The DWI process uses a metallic sheet and provides a cylindrically shaped container, having a thin wall 1b and a thicker bottom 1d. In a necking process the upper end portion 1c of the wall 1b is shaped radially inwards to gain a reduced opening to the can inside 1i, to be closed by the lid 2, as explained in figure 1a.

Figure 1c shows the can 1, the lid 2 and the closing devices 4,3 for the can's bottom end 1d in a detached explosive view. **Figure 1b** is an enlarged part of figure 1a, displaying the permanent mounting of the carrier part 3 to the can's bottom and the cap device 4, shown attached in a closed position. Two threads, one 4.1 at a socket 4a of the cap 4, and one at the outer radial face of the tube-shaped carrier 3, interact for opening (releasing) and/or closing action.

A can lid 2 is made from steel or aluminium. It is the upper end of the closed can. Although being similar to a commonly used easy open can end it has no easy open mechanism, i.e. no score line and no tab. Its function is limited to closing and sealing of the can body after filling. The can lid comprises a substantially flat end panel 2.1 which connects via an inner chime by a countersink 2.2 (groove) to a chuck wall terminating in an annular end flange portion 2.3 as shown in **Figure 1a** (left part), when laid into the open necked wall 1b,1c, not yet seamed. The end flange portion 2.3 is curled downward at its outer circumference. The inner surface of the end flange portion and curl are lined with a non displayed sealing compound which establishes liquid and gas tightness of the container after a (double) seam 2.4 has been formed by roll-in of the end flange and a can body flange 2.5 (body hook), after filling of the can, shown in the right part of **Figure 1a**.

Because of the absence of an easy open mechanism the panel 2.1 of the can lid maintains a flat and geometrically undistorted surface. As such, the panel provides an ideal base for extending the container's billboard through printing or labelling of additional messages and/or images. It is neither openable, nor closable. It may have a slightly domed shape.

A one-part cylindrically shaped spout 3 is of hollow tube-like design 3a made from a high molecular thermoplastic material. The outside portion of the spout is furnished with a thread 3.1 having between 1½ and 2½ revolutions at one end. The thread has a minimum of 3 and a maximum of 5, preferably four longitudinal interruptions 3.2 with an axial orientation parallel to the centre axis 100 of the spout 3. The base of each thread interruption holds an additional small grove projecting over the entire length of the thread interruption and is exceeding the same by a minor length at either end.

An end opposite of the threaded tube of the spout 3 contains two flanges 3.3 with radial outward orientation. Both flanges are separated by a distance "d", corresponding to the sheet thickness of the can base 1.1. After assembling the spout 3 inside the opening 1e of the can base, the flanges are thermo-sealed to either side of a heat-sealably coated material surface surrounding the aperture 1e of the can base, receiving the spout 3.

The spout's flange, permanently mounted to the outer side of the can base 1.1, connects via a number of between 5 and 15, preferably twelve straps 3.4 to a tamper evidence ring 3.5 with a u-shaped cross section. An actuator mechanism 4.2 for treating the tamper evidence ring is part of the closure cap design and is shown in the description of the corresponding part later.

An alternate embodiment of the spout 3 is shown in **Figures 3 and 4**, named spout 3' there. It has two parts. The two-part spout 3' is of tube-like design made from a high molecular thermoplastic material. The radial outer part of the spout is furnished with a thread 3.1' and a 360° sliding bed 3.2' at its inside. It also has between 4 and 8, preferably six window-like openings 3.3', preferably equally spaced around its circumference, next to two radial flange portions 3.4' used for mounting the outer part 3c of the spout to the can base 1.1. The slide bed 3.2' is located at the axial end portion of the spout part 3c opposite to the mounting flanges 3.4'. A 2 to 3 revolution thread is located at the flange end of the spout. The thread has several, preferably a minimum of 3 and a maximum of 4 or 5 longitudinal interruptions 3.5' with axial orientation parallel to the centre axis 100 of the spout.

The base of each thread interruption holds an additional grove projecting over the entire length of the thread interruption and is exceeding the same by a minor length at either end.

The end opposite of the threaded side of the spout 3' contains two flanges 3.4' with outward radial orientation. The flange at the outer position of the spout extends into an annular protrusion 3.6' of substantially circular cross section at its outer surface, facing axially. Both flanges are separated by a distance equivalent to the material thickness of the can base, as previously explained. After assembling the alternative spout 3' inside the opening 1e of the can base 1.1 the flanges are thermo-sealed to either side of a heat-sealably coated material surface surrounding the aperture 1e of the can base. By this attaching an opening edge of the opening 1c will be covered corrosion free.

The spout's flange located at the outer side of the can base connects via a number of between 5 and 15, preferably 12 thin straps 3.7' to a tamper evidence ring 3.8' with a substantially u-shaped cross section. An actuator mechanism 4.9" for detaching the tamper evidence ring is part of the closure cap design and is shown in the description later.

The radially inner part 3b of the spout 3' is furnished with further threads 3.9' each at its inner and at its outer radial face. Both threads are located at the same end portion of the inner spout part. The outer thread 3.9' at the outer side matches the inner thread 3.1' at the inner side of the outer spout part. The inner thread 3.9' at the inner side matches a thread at the outer radial face of the closing cap 4 and its socket 4a, which are shown in the description later.

The inner spout 3b terminates in a tapered portion 3.10' at its threaded end. It matches a slightly narrower tapered receiving portion in a panel of the closure cap for achieving a tight fit to keep both parts locked to each other during a part of the opening of the closure system. The tapers only disengage at the end of axial travel of the inner spout part 3b relative to the outer spout part 3c. This is when the inner spout part has fully telescoped (extended) outwardly during the first phase of the closure opening process. The tapers only lock again at the end of travel during the reclosing process.

The end of the inner spout part located at the far side from the threads contains an outwardly pointing radial flange 3.11' which travels in the sliding bed of the outer spout part during opening and closing of the reclosable closure. The flange terminates axial travel of the inner spout at both of the slide bed's extreme positions.

The flanged end of the inner spout part is designed to have between 4 and 8, preferably six gaps 3.12' to allow mechanical assembly of the inner spout part inside the outer spout part, and engagement of the radial flange 3.11' in said bed 3.2'.

The reclosing screw cap 4 of **Figures 1a to 1c** is of cylindrical design made from a high molecular thermoplast. Its outside diameter substantially corresponds to an outside diameter of the can wall 1b, when round. The cap has a centred inner tubular portion 4a at a panel 4.4 with a thread 4.1 at an inner side of the tube (female design). Both, thread and diameter of the inner "reclosability portion" match their corresponding counter part of the spout 3 (male design). This is called a socket 4a, 4.1.

The centred inner tubular portion also holds a u-shaped counter piece 4.2 of the tamper evidence feature of the reclosable closure system. u-shaped part at the cap 4 is segmented into between 4 and 15, preferably 12 circumferential sections 4.3. This allows "spring driven" engagement with the u-shaped tamper evidence ring 3.5 attached by straps 3.4 to the outer part of flanges 3.3 of the spout 3 only during first assembly of the cap 4, twisting it onto the thread 3.1 and by turning an axial displacement exerting a radial elastic deflection of the segments 4.3, prior to latching their hook portions over the counterhook of u-shaped ring 3.5. Figure 1b displays the locked position.

The "in principle u-shaped" tamper evidence ring 3.5 will be torn off by breaking the thin straps 3.4 during initial twisting opening of the reclosable closure system, and will remain captured in the u-shaped portions 4.3 inside the screw cap 4. Tamper evidence is recognisable by abrupt change in torque resistance and by pronounced acoustic means only during first time opening of the closure.

The lateral panel 4.4 in an inner portion of the screw cap 4 is furnished with a gasket type seal plate 4.5 to achieve gas and liquid tightness of the closed cap.

The panel 4.4 of the entire screw cap is substantially flat having a rim portion 4.6 near its outer circumference and an outer chime portion 4.7 as transition from the flat panel through the rim into a cylindrical wall 4.8.

The diameter of the rim portion and an inclination of the chime portion are chosen such that the closing cap 4 is nestable (for can stackability) with the can lid geometry, preferably radially outside the seam 2.4. Therewith, it is possible to safely stack filled cans on top of each other. The bottom rim of the cap 4 is nestable, chosen according to the seamed opposite end (lid). This is referred to as "nestable with the lid geometry".

An outer side of the cylindrical wall 4.8 of the cap is furnished with grip flutes 4.9 to ease the opening and closing operation for the consumer. A ribbed surface 4c faces radially outward, as one embodiment of a "gripping surface" for the cap 4.

The reclosable screw cap 4' of a further embodiment shown in **Figures 2a to 2c** is identical with the reclosable cap 4 above described, with the following exceptions.

The outer circumferential wall 4.1' of the screw cap 4' is of stepped design, having a diameter change along its axial extension. The stepped design has a diameter

identical to the can diameter at one end and a smaller diameter at the other end, prior to the chime portion 4.7. The outer sidewall is furnished with a minimum of 3 and a maximum of 7, preferably five latchkeys 4.2' located near a portion of transition 4.3' from the small diameter to the larger diameter. These latchkeys are to mechanically lock and secure an optional containment-vessel 5, which is shown later, having at least parts of threads Y.

The chime portion 4.7 in this embodiment also nests with a seam 2.4 of another can.

A further reclosing screw cap 4" is of circular design made from a high molecular thermoplast, as shown in **Figures 3a to 3c**. An outer circumferential wall 4.1" of the third screw cap 4" is of tubular design in its axial direction 100 and has the same diameter as the drinks can. It is connected via a chime portion 4.2" to a rim portion 4.3" of the screw cap. This rim portion 4.3" is also adapted to cooperate in a nesting/stacking manner with a seam corresponding to the seam 2.4 of the other end.

The chime portion 4.3" is furnished with a minimum of 3 and a maximum of 7, preferably five latchkeys 4.4". These latchkeys are to mechanically lock and secure an optional cylindrical vessel 5, which is explained later. The screw cap 4" also has a centred inner tubular socket portion with a thread 4.5" at its outer side. Both, thread and diameter of the inner "reclosability portion" match their corresponding counter part of the telescopic spout 3'. The axially facing inner surface of the panel of the screw cap 4" is furnished with an annular groove 4.6" of preferably tapered cross section, geometrically matching a preferably tapered end portion 3.10" of the telescopic part 3b of the spout 3'. Male and female taper interlock the telescopic spout part 3b with the screw cap 4" when the screw cap is in its clockwise extreme position closed. This friction lock enables to move the telescopic part of the spout 3' outside the container when the same is opened by counter clockwise rotation of the screw cap 4".

An inner surface of the panel of the screw cap 4" also has a groove 4.7", which is furnished with an inlet seal 4.8" geometrically matching an outward protrusion 3.6' at the outer flange of flanges 3.4' of the spout 3'. Seal and protrusion achieve gas and liquid tightness of the container when the reclosable closure is in closed position.

The panel of the reclosable screw cap 4" also holds an in principle u-shaped counter piece 4.9" of the tamper evidence feature 4.9", 3.8' of the reclosable closure, operating as shown before.

The u-shaped part 4.9" at the screw cap 4" is axially segmented into several, preferably between 4 and 15, or around twelve sections. This allows spring driven (elastic) engagement with the in principle u-shaped tamper evidence ring 3.8' attached by straps 3.7' to the outer flange of the fixed part 3c of the spout 3' only during first assembly of the screw cap. The tamper evidence ring will be torn off by breaking the straps during initial opening of the reclosable closure and will remain captured in the u-shaped portion inside the screw cap. Tamper evidence is recognisable by abrupt change in torque resistance and/or by pronounced acoustic means only during first time opening of the closure.

The reclosable cap 4"' of **Figures 4a to 4c** as further embodiment is substantially identical with the reclosable screw cap described under Embodiment 4" with the following exceptions.

Screw cap 4"' does have a diameter reduced panel 4.1"'. Whereas the reduced panel 4.1"' bears the same features like screw cap 4", bridging parts 4.4"' to the can body diameter provide a material reduced partly open construction. It comprises between three and seven, preferably five legs 4.2"', at least some of them with a container stacking feature and latchkeys 4.3"' to mechanically lock and secure an optional vessel 5, which is explained below, by corresponding counterlatches Y.

The legs 4.2"', operatively corresponding to the rim 4.6 of the first embodiment, is by geometry adapted to the seam 2.4, to enable the "stacking feature" by nesting readially inside or outside the seamed other end of a closed container positioned below. This also refers to the other end of the same container, as all of them are identically assumed.

The add-on containment vessel 5 of **Figure sets 3 and 4** is made from a high molecular thermoplastic material. It is preferably of cup-like design with an open top and a closed bottom 5b. The top geometry substantially fits the outside diameter of the container body in the bottom part of the wall 1b. The bottom 5b of the vessel is of a geometry 5b' similar to the contour of the screw caps 4; 4'; 4" and 4"' to allow stacking of the cup supplied containers.

The upper inside of the vessel holds a three to seven, preferably 5-gear thread parts 5.2 with interruptions 5.1 providing latch zones Y in a distance from the upper edge of the vessel 5. The distance substantially corresponds to the axial extension of the outer skirt 4.1", 4.2" or 4.1' including the respective chime or the axial length of the legs 4.2"'.

The interruptions 5.2 are matching the latchkeys 4.4''' or 4.2' or 4.3''' at the circumference of the different screw caps. Interlocking of the vessel and the container is done by clockwise rotation of the vessel around its centre axis 100 and relative to the container. Disengagement of the vessel is achieved by counter clockwise rotation of the vessel around its centre axis and relative to the container.

The caps 4'', 4''' are of flatter design in axial direction. They are preferred to have said detachable vessel 5 associated, reducing the overall axial length of the assembled package, and still allowing stacking with or without the vessel 5 in cooperation with the seam geometry 2.4 of the other end.

Assembly facilities of the component.

Can 1 and lid 2 will fit with all spout and screw cap designs, as well as vessel designs.

The one part spout 3 will fit with caps 4 and 4', with or without the vessel 5.

Two part spout 3' will fit with caps 4'' and 4'''.

Vessel 5 will fit with caps 4', 4'' and 4'''.

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